Chapter VIII
Collaborative Technology: Improving Team Cooperation and Awareness in Distance Learning for IT Education

Levent Yilmaz
Auburn University, USA

ABSTRACT

This chapter presents a set of requirements for next generation groupware systems to improve team cooperation and awareness in distance learning settings. The premise of the chapter is based on the observation that in distance learning online asynchronous (e.g., e-mail, conference tools) or synchronous (e.g., chat) mechanisms are used to facilitate collaboration and coordination to complete necessary tasks. However, students are neither trained in basic principles regarding how effective cooperation takes place, nor means for their realization. Basic methods of cooperation are delineated along with a set of requirements based on a critical analysis of the elements of cooperation and team awareness. The means for realizing these elements are also discussed to present strategies to develop the proposed elements. Two scenarios are examined to demonstrate the utility of collaboration to provide deep integration of communication and task accomplishment within a unified coherent framework.

INTRODUCTION

Information technology (IT) organizations increasingly rely on teams to address a variety of complex and challenging tasks (Salas & Fiore, 2004). Large complex software intensive system design, development, and management require considerable effort in collaboration and coordination among peers. Hence, teams have become an integral and essential component in every IT organization (Yilmaz & Phillips, 2006). Organizations believe that teams, effective teamwork, and engineers with proper skills to function in IT team projects can provide a competitive edge (Ellis, Gibbs, & Rein, 1991). Providing IT students the necessary educational tools and their principled use have the potential to improve the students' cooperation and cognition skills, which are critical for students to succeed in today's global economy (Carmel, 1999). Awareness of this trend influenced

instructors to incorporate group projects and research assignments into curriculum.

In distance learning, team projects are assigned to a group of students who are geographically dispersed. Hence, online asynchronous (e.g., e-mail, conference tools) or synchronous (e.g., chat) mechanisms are used to facilitate collaboration and coordination to complete necessary tasks. However, students are neither trained in basic principles regarding how effective cooperation takes place, nor means for their realization. Furthermore, existing educational collaborative technologies (i.e., groupware) provide a classical organizational view of communication and lack implicit coordination facilities that support shared mental model construction (team cognition). Awareness of other group members is a critical building block in the construction of team cognition, and consequently *computational support for awareness* in collaborative education tools is crucial for supporting team cognition (Endsley, 1995) in distributed student groups.

This chapter presents a framework and a strategy to help mitigate these shortcomings in existing distance learning groupware for IT education. First, the characteristics of team work in distance learning are elaborated to set the stage for discussing requirements for next generation collaborative education tools. Specifically, we compare how such teams are different than conventional teams in IT education. The significance of team cognition in conjunction with cooperation is emphasized in the distance learning context. Then, we discuss why cooperation in distance learning is difficult to do right. In particular, the problems that pull apart a student team in a virtual education environment are highlighted. In particular, dispersion, breakdown of traditional coordination and control mechanisms, team cohesion, and the substance (richness) of communication are presented as challenges (Carmel, 1999). A number of mitigation strategies, one of which is advanced collaborative instruction technologies, are proposed to counter the challenges. The chapter will then focus on a proposed framework for advancing the state of the art in collaborative instruction technology. The framework is based on fundamental methods of cooperation. The methods and underlying principles are then used to propose strategies to augment additional collaborative technologies to improve team cognition and cooperation skills of students. We will consider both generic collaborative technologies (e.g., e-mail, audio-conferencing, video-conferencing, and groupware platforms) and collaborative technology to support task specific solution for IT education.

BACKGROUND

Project awareness (Gutwin & Greenberg, 2004) is something people take for granted in everyday world. This is mainly due the fact that acquiring such awareness information is natural and simple; as such, it is rarely considered as an intentional activity. As a consequence, it is often overlooked in the design of educational tools and collaboration support frameworks such as groupware systems. The problem is that maintaining that awareness has proved difficult in current distributed educational groupware systems in which interaction mechanisms are poor and information resources are not designed to promote awareness.

Group Project Awareness

There are three main reasons why most educational groupware does not support project awareness. First, the input and output mechanisms are not capable of handling perceptual information available to face-to-face settings. Second, the amount of information generated by a user is much less in a virtual setting than a physical workspace. Third, the education groupware systems do not present even the limited awareness information to the user.